



## Proposed NASA-ISRO SAR Mission

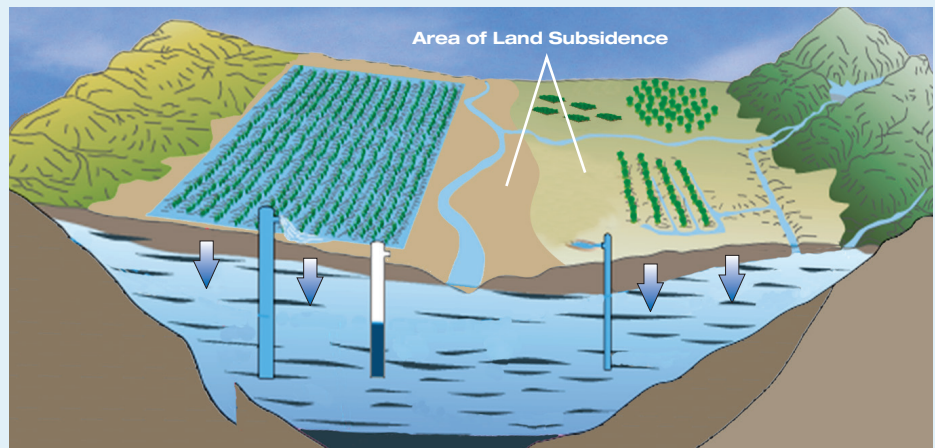


# Water: Sustaining Life

NISAR would measure changes in groundwater over the Earth's vulnerable arid regions.

### Understanding Aquifer Dynamics

Mapping and monitoring changes in land surface elevation with interferometric synthetic aperture radar (InSAR) may help fill in the gaps between monitoring wells. The ability to map surface deformation of a few millimeters monthly over large areas at resolutions of a few tens of meters has opened up new possibilities for remote monitoring of groundwater resources.

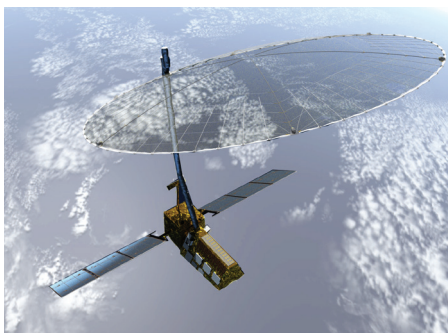


### Managing Water Resources

Water is necessary for life, both for drinking and for growing food. In the more arid parts of the world, rainfall and surface water can't satisfy the growing demands of the people who live in those regions. Groundwater makes up the difference, acting as a reservoir that can be tapped through wells. Unfortunately, climate change coupled with growing populations is causing increasing stress on groundwater resources around the world.

Over-exploitation of groundwater leads to lowering of the water table and, in alluvial basins, compaction of aquifers leading to sinking of the land surface (subsidence). Subsidence is often the first indication of over-exploitation and can also cause problems for infrastructure such as aqueducts, flood-control projects, highways, bridges, and railways. If subsidence continues for too long, it can lead to irreversible collapse of the aquifer system, reducing its ability to recharge when water is available.

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Artist's concept

### The Proposed NISAR Mission — All-Weather Day and Night Imaging

Orbiting radar captures the extent and motions of land and sea ice over time and with enough detail to reveal subtle changes. Radar penetrates clouds and operates day and night. It produces images that are detailed enough to see local changes, and has broad enough coverage to measure regional trends. The proposed NASA-ISRO SAR (NISAR) mission would acquire images of surface changes globally with millimeter accuracy and meter-scale resolution. It would capture images of the movements of the Earth over time and with sufficient detail to reveal what is happening below the surface. Rapid sampling over years to decades would allow for understanding groundwater dynamics. The detailed observations would reveal information about the migration of water and the state of aquifers.

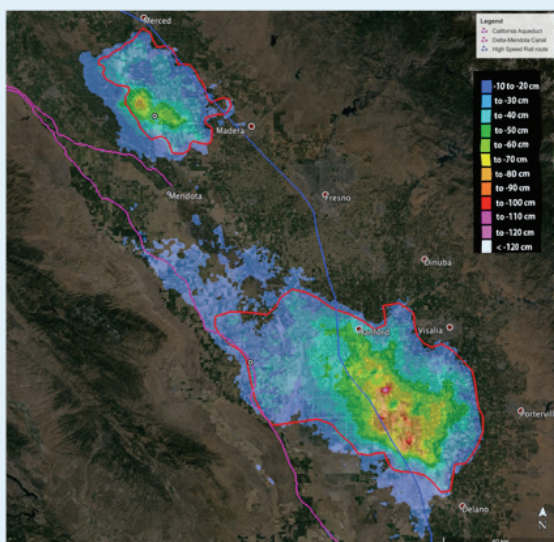
## Subsidence As a Measure of Groundwater Depletion

In order to increase resilience and adapt to changes, water resource managers need to be able to detect new areas of subsidence and to monitor known areas of continuing subsidence. This can also give an indication of groundwater depletion over long periods. Currently this is done through periodic leveling surveys and monitoring of water wells, but owing to lack of funds and the difficulty of mandating measurements at private wells, the data are sparse in space and time.

## Managing Water Globally

NISAR offers the promise of extending groundwater observations to regions of the world with no effective means to monitor the state of their aquifers. This would provide benefits to large segments of the global population dependent on groundwater to bridge gaps in surface and rain water supply. As Earth's climate changes, monitoring of this critical resource could help reduce conflicts over water. NISAR could also easily map flooded areas, even under vegetation canopies by using its polarimetric mode.

### Monitoring Subsidence



Total subsidence in the San Joaquin Valley, California, from 2007 to 2011 measured by InSAR. The subsidence bowl to the north, just south of Merced, is a relatively recent feature caused by a change from row crops to trees, which use more groundwater. Note how the California Aqueduct (purple) and the proposed High Speed Rail (blue) are both affected by subsidence. NISAR would provide this information on a regular basis.

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